English Translation of JP 06-350012

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(54) [Title of the Invention]

Optical data link, method for manufacturing the same, and apparatus for processing the same

(57) [Abstract]

[Object]

It is an object of the present invention to provide an optical data link for reducing the number of components and simplifying processing steps, a method for manufacturing the same, and an apparatus for processing the same.

[Constitution]

A lead frame 1 where an external output lead pin 5, an island section 4 with a component mounted thereon, a shield section 2 for shielding the component mounted on the island section 4, and a positioning mechanism 3 for supporting the bent shield section 2 to form a component mounting space between the shield section 2 and the island section 4 are integrally formed is used. The component mounting space formed between the shield section 2 fixed to a predetermined position by bending a predetermined portion of the lead frame 1 and the island section 4 facing the shield section 2 and on which the component has already been mounted is molded by a resin.

[Claims for the Patent]

[Claim 1]

An optical data link characterized in that a component mounting space formed between a shield section that is a portion of a lead frame fixed to a predetermined position by bending a predetermined portion of the lead frame and an island section that is a portion of the lead frame facing the shield section and on which a component has already been mounted is molded by a resin.

[Claim 2]

The optical data link according to claim 1, characterized in that the lead frame comprises: an external output lead pin; the island section with the component mounted thereon; the shield section for shielding the component mounted on the island section; and a positioning mechanism for supporting the bent shield section to form the component mounting space between the shield section and the island section; the lead pin, the island section, the shield section, and the positioning mechanism being integrally formed in the lead frame.

[Claim 3]

The optical data link according to claim 1 or 2, characterized in that etching is performed on one of surfaces of the lead frame at a portion to be bent.

[Claim 4]

The optical data link according to any one of claims 1 to 3, characterized in that the shield section that is a portion of the lead frame has an opening as an inlet for injecting a resin that molds the component mounted on the island section.

[Claim 5]

A method for manufacturing an optical data link comprising: a first process of bending a positioning mechanism and a shield

section formed in a portion of a lead frame in a vertical direction and further bending the shield section in a horizontal direction, thereby allowing the shield section supported by the positioning mechanism to face an island section with a component mounted thereon; and

a second process of injecting a resin into a component mounting space formed by allowing the shield section supported by the positioning mechanism to face the island section from an opening formed in the shield section, and performing molding.

[Claim 6]

The method for manufacturing an optical data link according to claim 5, characterized in that an unnecessary portion is removed from the lead frame by etching or pressing, and each portion of the lead frame is integrally formed into a lead pin, the island section, the positioning mechanism and the shield section.

[Claim 7]

An apparatus for processing an optical data link, comprising:

a suction head for fixing a lead frame;

a first bending jig for bending a shield section and a positioning mechanism as a portion of the lead frame fixed by the suction head in a vertical direction; and

a second bending jig for bending only the shield section in a horizontal direction out of the shield section and the positioning mechanism bent in the vertical direction.

[Detailed Description of the Invention]

[0001]

[Industrial Application Field]

The present invention relates to a structure of an optical data link that is an optical/electrical converter used in an optical LAN, digital public communication and the like, a method for manufacturing the optical data link, and an apparatus for processing the optical data link.

[0002]

[Conventional Art]

In the optical data link used in an optical LAN, digital public communication and the like, a connection between a photodiode and a preamplifier, or between a preamplifier and a light-emitting diode mounted on a lead frame is particularly susceptible to noise. Thus, conventionally, the optical data link has a structure in which the connection is shielded by a small metalized package in advance.

[0003]

To be more specific, shielding is performed by fixing a circuit board, which is connected to an optical connector including the photodiode or the light-emitting diode and on which a component is mounted as the preamplifier, inside the metalized package, and transfer molding is performed using a resin. After that, the shielding package (where the circuit board has been fixed therein and the transfer molding has been performed using the resin) is fixed onto the lead frame.

[0004]

[Problems to be Solved by the Invention]

The conventional optical data link is configured by shielding the circuit board (the preamplifier) with the component mounted in connection with the optical connector in advance by the metalized package, transfer-molding the inside of the package using the resin, and then, fixing the shielding package onto the lead frame as described above. Thus, there is

a problem that there are a plurality of packaging processes (packaging requires double work), and the number of components required in the packaging such as the metalized package is large.

[0005]

The present invention has been made to solve the aforementioned problems, and it is an object of the present invention to provide an optical data link for reducing the number of components and simplifying processing processes, a method for manufacturing the same, and an apparatus for processing the same.

[0006]

By reducing the number of components and simplifying the processing steps, the component cost can be reduced (or at least the status quo is maintained), and the processing cost can be reduced as an indirect effect.

[0007]

[Means for Solving the Problems]

An optical data link according to the present invention is characterized by using a portion of a lead frame on which an optical connector and a circuit board with a component mounted thereon as a preamplifier are mounted, as a shield member of the optical connector and the circuit board.

[0008]

That is, the optical data link is characterized in that the lead frame where an external output lead pin, an island section with a component mounted thereon, a shield section for shielding the component mounted on the island section, and a positioning mechanism for supporting the bent shield section to form a component mounting space between the shield section and the island section are integrally formed is used, and the component

mounting space formed between the shield section that is a portion of the lead frame fixed to a predetermined position by bending a predetermined portion of the lead frame and the island section that is a portion of the lead frame facing the shield section and on which the component has already been mounted is molded by a resin.

[0009]

Specifically, the optical data link is characterized in that etching is performed on one of surfaces of the lead frame at a portion to be bent, that is, a connection portion between the positioning mechanism instructing the shield section and the lead frame and a connection portion between the positioning mechanism and the shield section (referred to as half etching below). The optical data link is also characterized in that the shield section has an opening as an inlet for injecting a resin that transfer-molds the circuit board (on which the component has already been mounted) mounted on the island section.

[0010]

Meanwhile, a method for manufacturing the optical data link is characterized by comprising a first process of bending a positioning mechanism and a shield section formed in a portion of a lead frame having the aforementioned structure and integrally formed in advance in a vertical direction and further bending the shield section in a horizontal direction, thereby allowing the shield section supported by the positioning mechanism to face an island section with a component mounted thereon, and a second process of injecting a resin into a component mounting space formed by allowing the shield section supported by the positioning mechanism to face the island section from an opening formed in the shield section, and performing molding.

[0011]

The method for manufacturing the optical data link is also characterized in that an unnecessary portion is removed from the lead frame by etching or pressing in advance (the opening for injecting the molding resin is formed in the shield section at this time), and each portion such as the shield section, the positioning mechanism, and the island section is integrally formed, and specifically, half etching is performed on one of surfaces of the lead frame at a portion to be bent.

[0012]

Furthermore, the aforementioned optical data link, particularly, the lead frame is processed by an apparatus for processing an optical data link, comprising a suction head for fixing a lead frame, a first bending jig for bending a shield section and a positioning mechanism as a portion of the lead frame fixed by the suction head in a vertical direction, and a second bending jig for bending only the shield section in a horizontal direction out of the shield section and the positioning mechanism bent in the vertical direction.

[0013]

[Operation]

The optical data link according to the present invention uses a portion of the lead frame as a shield component instead of a conventional metalized package as described above. Therefore, the conventional metalized package composed of two or more components is not required, and packaging is completed only by the conventionally used lead frame although its shape is changed by etching or pressing, so that the number of components can be reduced (the cost per component is not affected).

[0014]

Also, in the optical data link, (in order not to increase the processing cost), it is necessary to automate the processing step for bending the shield section that is a portion of the lead frame in the horizontal direction and the vertical direction such that the shield section is located above the circuit board which has already been mounted on the island section (so as to shield the circuit board). Thus, half etching is performed on the portion to be bent of the lead frame in advance in order to facilitate the bending process.

[0015]

By determining a bending position and a bending angle by the structure of the lead frame in advance as described above, a simple system which can be developed in a short time (the processing apparatus with a simple structure) can be used.

[0016]

[Embodiments]

In the following, one embodiment of the present invention will be described with reference to Figures 1 to 9. Note that the same components are assigned the same reference numerals in the drawings to omit descriptions thereof.

[0017]

Figure 1 is a view illustrating the structure of a lead frame that constitutes an optical data link according to the present invention. An external output lead pin 5, an island section 4 for mounting a circuit board with a component mounted thereon as a preamplifier, a shield section 2 for shielding the circuit board mounted on the island section 4 (an opening 6 for injecting a molding resin is provided in the shield section 2), and a positioning mechanism 3 for supporting the bent shield section 2 to form a component mounting space between the shield

section 2 and the island section 4 are integrally formed in a lead frame 1 in advance by etching or pressing.

[0018]

In particular, half etching is performed on a portion to be bent of the lead frame 1, that is, a connection portion between the island section 4 and the positioning mechanism 3 and a connection portion between the positioning mechanism 3 and the shield section 2 as shown in Figure 2. In Figure 2, reference character A (the black portion in Figure 2) denotes that the front surface side (the near side in the drawing) is etched, and reference character B (the striped portion) denotes that the back surface side is etched.

[0019]

By half-etching the lead frame 1 in advance as shown in Figure 3(a), the lead frame 1 is easily bent in a vertical direction (Figure 3(b)) and further in a horizontal direction (Figure 3(c)). Another advantage of performing the half etching in advance is that a bending position can be freely selected by changing the position where the half etching is performed, and that a bending angle can be freely controlled by changing the degree of half etching (the depth of half etching).

[0020]

Next, a method for manufacturing the optical data link, particularly the lead frame by using an apparatus for processing the optical data link will be described with reference to Figures 4 to 8.

[0021]

In a first process, the lead frame 1 on which an optical connector including a photodiode or a light-emitting diode and the circuit board with the component mounted thereon have been already mounted is sucked and fixed to a suction band 7 of the

processing apparatus first as shown in Figure 4(a). A bending jig 8 having a projection 8a is pressed against the sucked and fixed lead frame 1 from the back surface (the projection 8a is adjusted to be at the same position as the shield section 2 and the positioning mechanism 3 in advance), so that the shield section 2 and the positioning mechanism 3 are bent in the vertical direction as shown in Figure 4(b).

[0022]

Since the half etching is performed on the portion to be bent in advance, the positioning mechanism 3 is easily mountain-folded (bent as shown in Figure 4(b)) without the assistance of the bending jig when the shield section 2 is valley-folded (bent in the vertical direction), thereby working as a support member for the shield section 2.

[0023]

Although the lead frame 1 where the aforementioned bending step in the vertical direction has been finished is shown in Figure 5, the circuit board with the component mounted thereon as the preamplifier mounted on the island section 4, and the optical connector including the photodiode or the light-emitting diode are not shown in Figure 5.

[0024]

Subsequently, a stem (the lead pin) of the optical connector and the circuit board mounted on the lead frame 1 where the shield section 2 and the positioning mechanism 3 are bent in the vertical direction are connected to each other by a wire, and then, the shield section 2 that is a portion of the lead frame 1 fixed by a fixing jig 9 as shown in Figure 6(a) is bent to a position facing the island section 4 by horizontally moving a bending jig 10. Lastly, the circuit board mounted on the island section 4 and the lead pin 5 of the lead frame 1 are

connected to each other by a wire. Figures 6(b) to 6(d) show a state in which the bending jig 10 is horizontally moved by enlarging a portion C in Figure 6(a). It is shown that the positioning mechanism 3 works as the support member for the shield section 2.

[0025]

The lead frame 1 where the aforementioned bending step in the horizontal direction has been finished is shown in Figure 7. Furthermore, Figure 8 specifically shows a finished state in which the circuit board with the component mounted thereon as the preamplifier mounted on the island section 4 and the optical connector are entirely connected to each other. Specifically, in Figure 8, reference numeral 11 denotes the optical connector, and reference numeral 12 denotes the circuit board.

[0026]

Next, in a second step, the component mounting space (a space formed between the shield section 2 and the island section 4) of the lead frame 1 where the connection of the respective sections using the wire and the bending process have been finished is transfer-molded by a resin.

[0027]

Here, it is necessary to note the following points.

(1) The shield section 2 does not block the flow of resin.

(2) The shield section 2 is not affected by the flow of resin to cause a short circuit with the component mounted on the circuit board 12 (however, the inventors have confirmed that the short-circuit is not caused when the flow of molding resin is parallel to the lead frame 1).

Therefore, in consideration of the above points, the opening 6 provided in the shield section 2 (the opening for injecting the molding resin) is allowed to have an area of 40%

of that of the shield section 2, so that the optical data link can be manufactured without blocking the flow of resin (the above point (1)), and without causing a short-circuit between the shield section 2 and the component mounted on the circuit board 12.

[0028]

The transceiver type optical data link in which a transmitting function and a receiving function are integrated is described as the optical data link in the aforementioned embodiment. A shielding effect obtained by the shielding method according to the present invention is shown in Figure 9.

[0029]

The transceiver type module has a problem of "crosstalk" that the receiving side receives noise generated on the transmitting side and sensitivity is reduced. Figure 9 is a view illustrating a result of measuring the crosstalk in each portion of the optical data link.

[0030]

The portions where the crosstalk was measured include the stem corresponding to the lead pin of the optical connector 11 (denoted by (a) in Figure 9), the end on the O/E side of the circuit board 12 (denoted by (b) in Figure 9), the preamplifier (denoted by (c) in Figure 9), and the end on the pin side of the circuit board 12 (denoted by (d) in Figure 9). Figure 9 shows that the crosstalk is reduced to 1.2 dB which causes no problem from the practical point of view by covering the circuit board 12 by the shield section 2 that is a portion of the lead frame 1.

[0031]

[Advantages of the Invention]

As described above, according to the present invention, a portion of the lead frame is used as a shield component instead of a conventional metalized package. Therefore, there is an advantage that the number of components can be reduced since the conventional metalized package composed of two or more components is not required and packaging is completed only by the conventionally used lead frame although its shape is changed by etching or pressing.

[0032]

Also, since the half etching is performed on the portion to be bent of the lead frame constituting the optical data link in advance, the bending process in the horizontal direction and the vertical direction can be easily performed. Furthermore, the bending position and the bending angle can be freely controlled by the structure of the lead frame by changing the position and depth where the half etching is performed in advance. Therefore, there is an advantage that a simple system which can be developed in a short time (the processing apparatus with a simple structure) can be used.

[Brief Description of the Drawings]

[Figure 1]

Figure 1 is a perspective view illustrating the structure of a lead frame that constitutes an optical data link according to the present invention.

[Figure 2]

Figure 2 is a view illustrating the structure of the lead frame, particularly a portion to be bent, that constitutes the optical data link according to the present invention.

[Figure 3]

Figures 3 are views illustrating the sectional structure of the lead frame, particularly the portion to be bent, that

constitutes the optical data link according to the present invention.

[Figure 4]

Figures 4 are views illustrating a processing step for bending a portion of the lead frame that constitutes the optical data link according to the present invention in a vertical direction (a first step).

[Figure 5]

Figure 5 is a perspective view illustrating a state in which the portion of the lead frame that constitutes the optical data link according to the present invention is bent in the vertical direction.

[Figure 6]

Figures 6 are views illustrating a processing step for bending a portion of the lead frame that constitutes the optical data link according to the present invention in a horizontal direction (a first step).

[Figure 7]

Figure 7 is a perspective view illustrating a state in which the portion of the lead frame that constitutes the optical data link according to the present invention is bent in the horizontal direction.

[Figure 8]

Figure 8 is a perspective view illustrating a state in which the first step of the lead frame that constitutes the optical data link according to the present invention is finished.

[Figure 9]

Figure 9 is a view illustrating a shielding effect of the optical data link according to the present invention.

[Description of Symbols]

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1: Lead frame

2: Shield section

3: Positioning mechanism

4: Island section

5: Lead pin

6: Opening (for injecting a resin)

7: Suction head

8, 10: Bending jig (including a projection 8a)

11: Optical connector (including a photodiode)

12: Circuit board (preamplifier)

[Figure 9]

CROSSTALK [dB]

LENGTH (mm)

(a) POSITION OF STEM SECTION

(b) END OF CIRCUIT BOARD (O/E SIDE)

(c) PREAMPLIFIER

(d) END OF CIRCUIT BOARD (LEAD PIN SIDE)